--21. (new) The process according to claim 18, wherein the density of the layer is increased by being mechanically compacted.--

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R E M A R K S

The application has been amended so as to place it in condition for allowance at the time of the next Official Action.

The abstract has been amended to correct formal matters.

The specification has been amended to insert section headings and to correct typographical errors.

Accompanying the present amendment is a request to amend Figures 4A-4E to correct various reference characters.

Claims 13-21 are present in the application.

Claims 1-5 have been cancelled.

New claims 13-21 have been inserted. New claims 13-16 incorporate the subject matters of claims 1, 3 and 4. New independent claim 17 incorporates the subject matter of claim 2. New claims 18-21 incorporate the subject matter of claims 3-5.

Claims 1-5 were rejected under 35 USC §112, second paragraph, as being indefinite.

New claims 13-21 have been drafted to avoid the basis for rejection under 35 USC §112, second paragraph, set forth in the Official Action.

Claims 1 and 5 were rejected under 35 USC §102(b) as being clearly anticipated by BOURELL et al. 5,382,308. Claim 1 was rejected under 35 USC §102(b) as being clearly anticipated by BEAMAN et al. 5,053,090. Claims 1-5 were rejected under 35 USC §103(a) as being unpatentable over BOURELL et al. in view of BEAMAN et al. Applicants respectfully traverse these rejections as applied to new claims 13-21.

The claimed inventive process for rapid prototyping includes sintering in solid phase of any powder, particularly ceramic powders. By the inventive process, homogeneous pieces having precise dimensions are obtained.

Concerning the sintering in solid phase, the temperature of sintering is always lower than the temperature of melting of the powders to be sintered. During sintering in solid phase, connection regions called grain joints, form between the particles in contact. Furthermore, the sintering in solid phase produces no variation of volume and no stress.

The sintering in solid phase is different from sintering in liquid phase. During sintering in liquid phase, the temperature of sintering is higher than the temperature of melting of some particles which act as a binder as they melt. The sintering in liquid phase is considered as a particle binding operation. The piece obtained by sintering in liquid phase is not homogeneous and has lower mechanic characteristics.

BOURELL et al. fail to describe a process for rapid prototyping by sintering in solid phase. BOURELL et al. describe a sintering in liquid phase. See Figs. 9-11; column 1, lines 24-27; column 4, lines 11-25; column 6, lines 23-61 and claim 1 of BOURELL et al.

With the mixture of powders described by BOURELL et al., the particles of the material having the lower melting point act as a binder as they melt for connecting the particles of the other material.

BEAMAN et al. describe a selective sintering process, but not a process for rapid prototyping by sintering in solid phase. BEAMAN et al. describe sintering by densification and the powder attains a high bulk density during sintering. This densification creates a significant variation in volume between the powder before and after sintering, which creates a lot of stress in the piece obtained.

The process described by BEAMAN et al. does not employ mechanical compaction to increase density prior to sintering.

In sharp contrast to the processes described by BOURELL et al. and BEAMAN et al., Applicants' claimed inventive process requires sintering and solid phase of a powder or a mixture of powders. By the sintering and solid phase, none of the powder is melted during the steps of heating or sweeping of the layer of powder with a laser beam. Claims 17-21 recite densifying of the heated powder prior to sweeping of the layer with a laser beam.

In view of the above amendments and remarks, Applicants respectfully submit that the inventive process of claims 13-21 is neither anticipated by nor would have been obvious to one of ordinary skill in the art in view of BOURELL et al., BEAMAN et al., or any combination thereof.

In light of the amendments discussed above, Applicants believe that the present application is in condition for allowance and an early indication of the same is respectfully requested.

If the Examiner has any questions or requires clarification, the Examiner may contact the undersigned Agent so that this application may continue to be expeditiously advanced.

Attached hereto is a marked-up version of the changes made to the specification. The attached page is captioned "VERSION WITH MARKINGS TO SHOW CHANGES MADE."

Respectfully submitted,

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

Page 2, replace the second paragraph, beginning on line 3, as follows:

--A second process consists in sintering in liquid phase a mixture of powder materials, one of the materials having a relatively low [metal] melting temperature of the order of several hundreds of degrees. Here again, the temperature level generated by the laser is relatively low because of the low melting temperature of one of the materials. It should be noted that the phenomenon commonly called sintering is a sintering in liquid phase and that it is more like cementing of grains, the material of a relatively low fusion temperature being used as a binder. In this case, the piece obtained is not homogeneous and the dimensional precision is relatively mediocre. Thus, the criterion of dimensional precision is not essential in this case because the operator can easily true by machining the dimensions of the pieces thus obtained.--

Page 9, replace the paragraph beginning on line 20 as follows:

--Pistons 44, 46 are provided to move in translation respectively in the cylinders 38, 40. Each piston 44, 46 is fixed to the upper end of a rod [38] 48, whose lower end is fixed to an arm 50 connected to means 52 and 54 for controlling the pistons 44, 46, respectively. These control means 52 and 54, in

the form for example of a stepping motor, are subject to the computer interface which controls the rising and falling of said pistons.--

Page 11, replace the paragraph beginning on line 15, as follows:

--On the working plane 28, means [68] 86 for forming a layer and means 88 for compacting, can move in the direction defined by the right angle line connecting the centers of the cylinders 38, 40.--

Page 12, replace the paragraph beginning on line 1, as follows:

--Two rods 96, disposed at each end of the roller 94, permit connecting the screed 90 to the compacting roller 94 which is fixed to an arm 98 connected to control means 100 for the layering means 86 and compacting means 88. These control means 100, in the form for example of a stepping motor, are also controlled by the computer interface which at the same time controls the movements of the pistons 44, 46, the movements of the screed 90 and of the roller [44] 94, as will be explained hereafter.--

Page 13, replace the first paragraph as follows:

--During phase 2, shown in Figure 4C, the screed 90 has finished spreading the quantity 104 of powder, and the roller [92] 94 is located at point A at the surface of the layer 106 adjacent a first point of tangency 108 of said roller with the working cylinder 38. At this time, the piston 44 of the working cylinder 38 rises by 100 μm such that a portion of the layer 106 is disposed above the working plane. The roller [92] 94 then compacts a region 110 of the layer 106 which extends from point A to point B located at the surface of the layer 106 adjacent a second point of tangency 112 of said roller with the working cylinder 38.--

Page 13, replace the second paragraph beginning on line 12 as follows:

--During phase 3, shown in Figure 4D, the piston 44 of the working cylinder descends by 100 μm, to avoid compacting the edges of the working cylinder 38. The roller [92] 94, as well as the screed 90, return to the initial position shown in Figure 4A.--